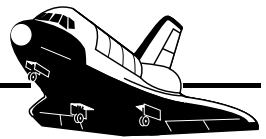


An Educational Publication of the
National Aeronautics and
Space Administration

MH-017/1-93

Mission Highlights STS-53



Space Shuttle *Discovery*

December 2 - 9, 1992

Commander:

David M. Walker (CAPT, USN)

Pilot:

Robert D. Cabana (COL, USMC)

Mission Specialists:

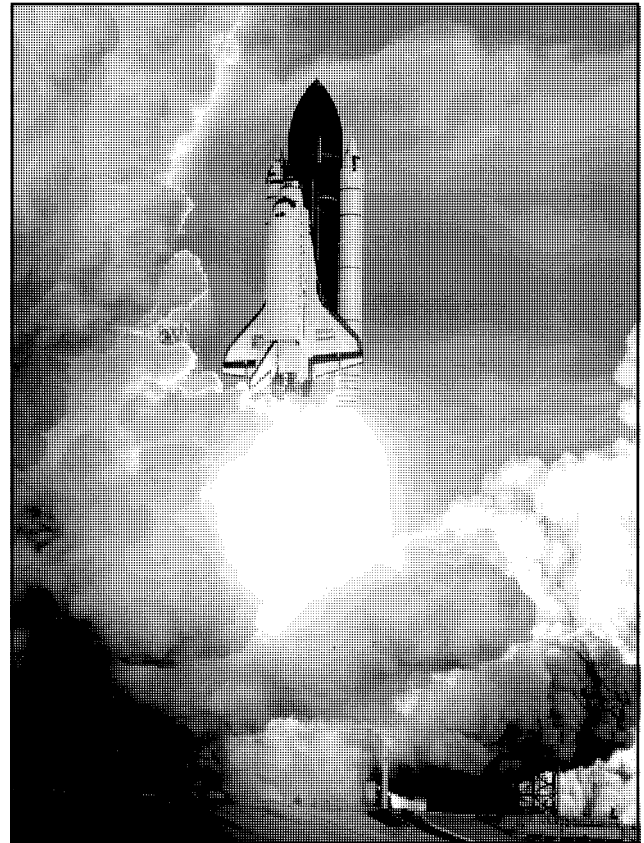
Guion S. Bluford, Jr. (COL, USAF)

James S. Voss (LTC, USA)

M. Richard Clifford (LTC, USA)

Major Mission Accomplishments

- Completed the eighth Space Shuttle flight of 1992 and the last planned mission dedicated to the Department of Defense.
- Deployed the Department of Defense-1 satellite.
- Achieved excellent results on the HERCULES (Hand-held, Earth-oriented, Real-time, Cooperative targeting, and Environmental System) and the Glow/ Cryogenic Heat Pipe experiment.
- Tested new fluid handling devices in the Fluid Acquisition and Resupply Experiment designed to improve the ability to capture and transfer liquids from a tank.
- Successfully locked onto a laser during the BLAST experiment which tested the concept of communications between ground personnel and orbiting spacecraft through lasers.
- Performed medical experiments to learn about how the human body adapts to microgravity and readapts to the normal gravity environment after landing.
- Operated an experiment designed to demonstrate the ability to produce better pharmaceutical products in space than on Earth.



Liftoff of Discovery from the Kennedy Space Center Launch Pad 39A.

During the early morning hours of December 2, the Space Shuttle *Discovery* began its 15th mission by thundering off the launch pad at the Kennedy Space Center (KSC) in Florida. The launch control team held the launch countdown at the T-9 minutes mark for over an hour to allow the sun to melt a layer of ice that had formed around the Shuttle's external tank. Launch controllers were concerned about ice on the external tank because the ice could shake loose during launch and damage the fragile tiles on the underside of the Shuttle.

STS-53 was the last planned Shuttle mission dedicated to the Department of Defense (DOD). The primary payload in *Discovery's* payload bay was the classified deployable satellite called Department of Defense-1 (DOD-1). The all military crew of five included astronauts from the Army, Navy, Air Force, and Marines.

The Space Shuttle launched into a 57 degree orbit 370 kilometers high. After deployment of the DOD-1 satellite at 1:18 P.M. CST, the crew fired the Orbital Maneuvering System (OMS) engines to lower *Discovery* to a 324 km altitude where it stayed for the remainder of the mission.

The first part of the STS-53 mission was classified while the crew worked on deployment of the DOD-1 satellite. After the satellite was successfully deployed on the first day, the rest of the mission was unclassified. The unclassified secondary payloads on the flight, became top priority for the remainder of the seven day mission.

The crew unpacked and activated the Radiation Monitoring Experiment (RME) and the Cosmic Radiation Effects and Activation Monitor (CREAM) before they went to sleep on the first day. Both of these experiments measured the radiation environment of low-Earth orbit. With a better understanding of the radiation environment, engineers will be able to design more effective radiation shields for both the people and the electronic equipment in future spacecraft.



STS-53 Crewmembers (L to R, back) Robert D. Cabana, David M. Walker, (L to R, front) James S. Voss, Guion S. Bluford, M. Richard Clifford.

An experiment in the middeck of *Discovery*, called the Fluid Acquisition and Resupply Experiment (FARE), tested some new devices made to efficiently collect and expel liquids from tanks in microgravity. While in orbit (free-fall), liquids can float around inside tanks unpredictably, which makes it difficult to capture and transfer all of the fluid out of the tank. On STS-53, the crew transferred colored water between two clear acrylic tanks eight times at various pressures and flow rates while taping the fluid motion with video camcorders. The images on the videotapes will be evaluated by scientists after the mission to determine how well the new fluid acquisition devices performed and to see how they can improve on their design. This research will help to lower the cost of servicing long duration spacecraft such as Space Station *Freedom* by improving our ability to transfer liquids in microgravity without leaving excess liquid in the supply tanks.

The high vantage point of space could be used to covertly communicate with people on the ground such as troops, ships, or even downed pilots through the use of lasers. The Battlefield Laser Acquisition Sensor Test (BLAST) was flown on STS-53 to test that concept. Two stationary and three mobile

ground laser sites aimed their lasers at *Discovery* as it passed overhead.

By coordinating the efforts of the crew of *Discovery* and the laser sites, the crew successfully locked onto the ground laser on two separate occasions. Several additional attempts were made during the mission, but problems with the ground stations and poor weather conditions thwarted those attempts.

The Orbital Debris Radar Calibration Spheres (ODERACS) shared the payload bay with the DOD-1 satellite, but was not deployed. Six metal spheres were planned to be released from ODERACS which would have remained in orbit after *Discovery* returned to Earth. Engineers would have used the spheres to calibrate instruments on Earth which track orbital debris. However, when the crew attempted to communicate with the experiment through a small computer, the experiment did not respond as expected. Ground controllers and the crew investigated the problem and determined that a battery had been drained prior to launch. Without this battery, it was impossible to deploy the spheres. ODERACS will fly again on a future Shuttle mission after the battery problem is resolved.

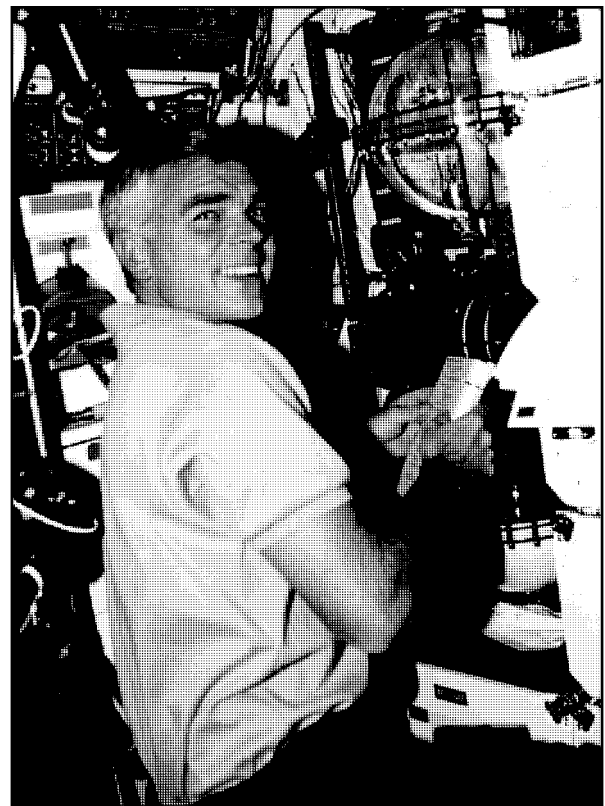
The Glow experiment/Cryogenic Heat Pipe experiment (GCP) in the cargo bay of *Discovery* worked as planned. The Glow experiment measured the extreme ultraviolet light energy produced as the orbiter raced through the upper reaches of the atmosphere at 28,000 km/hr. The Cryogenic Heat Pipe experiment measured the performance of liquid oxygen heat pipes in microgravity.

The *Discovery* crew also operated three DOD sponsored medical experiments. The Visual Function Tester-2 experiment tested the changes in visual acuity brought on by space flight. The Space Tissue Loss experiment studied the changes in the amount of bone and muscle cell degradation that occurs while in orbit. The crew also completed the Microcapsules In Space experiment to demonstrate that better pharmaceutical microcapsules can be produced in a microgravity environment than is possible on Earth.

Two photographic experiments sponsored by DOD performed well during the

mission. The Cloud Logic to Optimize the Use of Defense Systems was used to photograph several cloud formations for analysis after the mission. The Hand-held, Earth-oriented, Real-time, Cooperative, User-friendly, Location targeting, and Environmental System (HERCULES) was designed to calculate the latitude and longitude of an Earth viewing site. This data was recorded digitally along with the image and could be viewed later on the Shuttle's closed circuit television system. HERCULES was used to photograph over 200 subjects--more than eight times what was required.

Discovery was scheduled to land at the Kennedy Space Center Shuttle Landing Facility at the end of the seven day flight, but because of low clouds at KSC, the Mission Control Center decided to land at Edwards Air Force Base in California after the Shuttle made one more lap around the Earth. The Shuttle touched down at Edwards at 2:43 P.M. CST on Wednesday, December 9, ending the last Shuttle flight dedicated to the DOD.



M. Richard Clifford works with the Fluid Acquisition and Resupply Experiment in the middeck of *Discovery*.

Mission Facts

Orbiter: *Discovery*

Mission Dates: December 2 - 9, 1992

Commander: David M. Walker (CAPT, USN)

Pilot: Robert D. Cabana (COL, USMC)

Mission Specialist: Guion S. Bluford, Jr. (COL, USAF)

Mission Specialist: James S. Voss (LTC, USA)

Mission Specialist: M. Richard Clifford (LTC, USA)

Mission Duration: 7 days, 7 hours, 19 minutes

Kilometers Traveled: 4,885,835 km

Orbit Inclination: 57 degrees

Orbits of Earth: 116

Orbital Altitude: 370 km

Payload Weight Up: 11,893 kg

Orbiter Landing Weight: 87,825 kg

Landed: Edwards Air Force Base Runway 22

Payloads and Experiments:

DOD - 1 - Department of Defense - 1

BLAST - Battlefield Laser Acquisition Sensor Test

CLOUDS - Cloud Logic to Optimize Use of Defense Systems

CREAM - Cosmic Radiation Effects and Activation Monitor

FARE - Fluid Acquisition and Resupply Experiment

GCP - Glow experiment/Cryogenic Heat Pipe experiment Payload

HERCULES - Hand-held, Earth-oriented, Real-time, Cooperative, User-friendly, Location targeting, and Environmental System

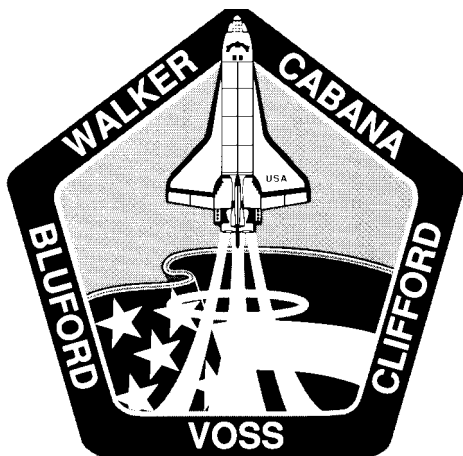
MIS - Microcapsules In Space

ODERACS - Orbital Debris Radar Calibration Spheres Project

RME III - Radiation Monitoring Experiment III

STL - Space Tissue Loss Experiment

VFT-2 - Visual Function Tester-2



STS-53 Crew Patch

Crew Biographies

Commander: David M. Walker (CAPT, USN)

David Walker was born in Columbus, Georgia, but considers Eustis, Florida, his hometown. He graduated from the U. S. Naval Academy in 1966, and received his Naval Aviator Wings in 1967. After two combat cruises aboard the USS Enterprise and USS America flying F4 Phantoms, Walker attended the USAF Aerospace Research Pilot School at Edwards Air Force Base, California, in 1971. From 1972 through 1975, Walker was assigned to the Naval Air Test Center at Patuxent River, Maryland, as an experimental test pilot, then returned to the fighter community in F14 Tomcats for two Mediterranean cruises prior to selection by NASA to the 1978 astronaut class. He has logged over 6,000 flying hours in more than 40 different types of aircraft. Walker was pilot of STS-51A aboard *Discovery* in November 1984 and was commander of STS-30 on *Atlantis* in May 1989.

Pilot: Robert D. Cabana (COL, USMC)

Robert Cabana was born and raised in Minneapolis, Minnesota. He received a bachelor of science degree in mathematics from the U. S. Naval Academy in Annapolis, Maryland. After graduation, he was commissioned in the United States Marine Corps and earned his wings as a Naval flight officer and a Naval aviator flying the A-6 Intruder with the 1st and 2nd Marine Aircraft Wings. Following his graduation from U. S. Naval Test Pilot School in Patuxent River, Maryland, he flew numerous ordnance and flight system test projects in the A-4 and A-6 airplanes and participated in development of the flight control system for the X-29 flight technology demonstrator. He has logged over 4,300 hours flying time. Cabana was selected to be an astronaut in 1985 and flew his first mission as the pilot of *Discovery* on STS-41 in October 1990.

Mission Specialist: Guion S. Bluford, Jr. (COL, USAF)

Guy Bluford was born and raised in Philadelphia, Pennsylvania. He received a bachelor of science degree in aerospace engineering from Penn State University and master of science and doctorate of philosophy degrees in aerospace engineering from the Air Force Institute of Technology. He also has a master's degree in business administration from the University of Houston. After graduating from Air Force pilot training, he flew 144 combat missions in Vietnam in the F4C Phantom II and then was an instructor pilot in T-38 aircraft. Bluford later served as an aerospace engineer and branch chief in the Air Force Flight Dynamics Laboratory. He has logged over 5,500 flying hours in more than 10 different types of aircraft. He became an astronaut in 1978 and flew as a mission specialist on STS-8, STS-61A, and STS-39.

Mission Specialist: James S. Voss (LTC, USA)

Jim Voss was born in Cardova, Alabama, but considers Opelika, Alabama, to be his hometown. He earned a bachelor of science degree in aerospace engineering from Auburn University and a master of science degree in aerospace engineering sciences from the University of Colorado. After completing airborne and ranger training, Voss served as an infantry platoon leader, intelligence staff officer, and company commander in Germany, then taught in the Department of Mechanics at West Point. He graduated from the U. S. Naval Test Pilot School and served as an Army flight test engineer. At NASA, Voss worked as a vehicle integration test engineer before becoming an astronaut in 1987. He flew as a mission specialist on STS-44 in November 1991.

Mission Specialist: M. Richard Clifford (LTC, USA)

Rich Clifford was born in San Bernadino, California, but considers Ogden, Utah, to be his hometown. He earned a bachelor of science degree from the United States Military Academy and a master of science degree in aerospace engineering from the Georgia Institute of Technology. Upon graduation from West Point, Clifford served as a platoon leader with the 10th Cavalry. He then completed pilot training as the top graduate of his class. He served in a variety of positions with the 2nd Armored Cavalry Regiment in Germany and was an assistant professor of mechanical engineering at West Point. Clifford became a test pilot following graduation from the U. S. Naval Test Pilot School in 1986. He has flown over 2,700 hours in more than 50 types of fixed and rotary wing aircraft. Clifford was selected as a NASA astronaut in 1990. This was his first space flight.